Water Quality of the Concho River System around San Angelo, TX

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Abstract:

This study analyzes and compares the quality of surface water in areas that differ in urban development around San Angelo, Texas. Using water samples from the San Angelo water sheds and an additional watershed from Ballinger, Texas, a Permutational Multivariate Analysis of Variance (MANOVA) was performed. Statistically significant differences were recorded based off the various sites but not between the months analyzed in this study. These findings suggest that a few specific water quality parameters are driving the changes throughout the water systems.

Introduction:

Water availability is a major concern for human populations in arid environments. In places like west Texas, both surface and ground water could be used for household use. As such, the quality of water as determined by the concentration of dissolved solutes is of utmost concern. Surface waters include all water in the lakes, streams, and river systems. The solutes in the water typically derive from dissolution of the soils during runoff, but humans can alter the water chemistry in various ways (Fig. 1).

Objectives:

1) Analyze water quality parameters based off sites in the San Angelo water shed system.
2) Compare the water quality parameters between the months this study was conducted.

Methods:

A total of 6 sites were analyzed from the San Angelo area; one Lake Nasworthy site and 5 Concho River sites (Fig. 2). An additional site in Ballinger, Texas, was sampled from a different watershed region, the Colorado River. Samples were collected from each site in the months of November 2017, January 2018, and February 2018. LaMotte Pollution Test Kits I, II, and III were used to test for water quality parameters including pH, chlorine, chloride, orthophosphate, nitrate-nitrogen, ammonia-nitrogen, alkalinity, color (APHA), hardness, and turbidity, as well as the industrial pollutants chromate, copper, iron, sulfide, zinc, and cyanide. Permutational MANOVA and subsequent post-hoc tests were ran in additional to the ordination plot (Fig. 2).

Figure 1. General flow chart of water quality parameters.

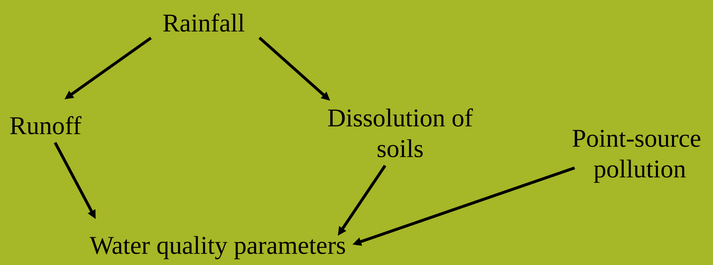


Figure 2. Map of the site locations. Ballinger site not included.

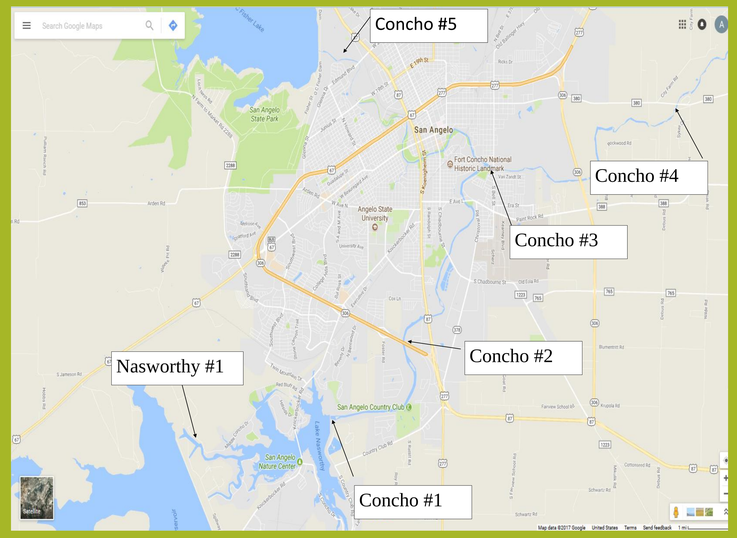
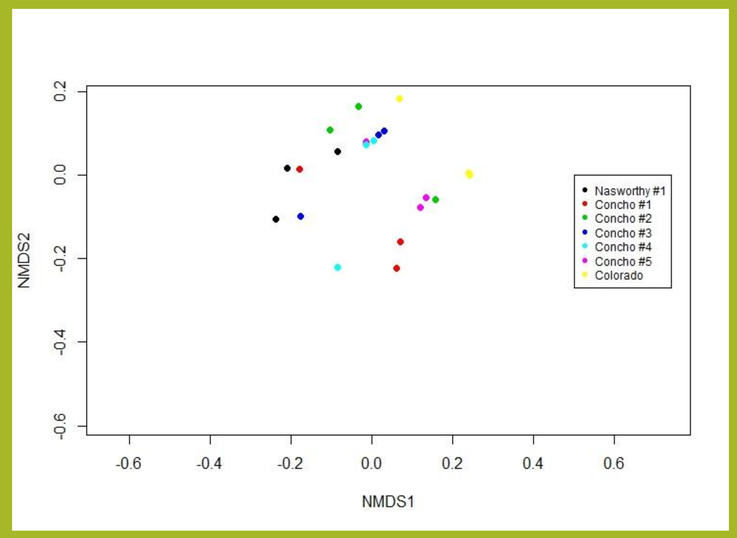


Table I.
Table of the raw data collected from this study. It should be noted that the purpose of this study is to analyze the pattern of the parameters, not the absolute value of the individual data point. Refer to Fig. 2 for location reference.

Site	Month	pH	Nitrate-Nitrogen	Ammonia-Nitrogen	Chlorine	Zinc	Chromate	Color	Alkalinity	Hardness	Chloride	Turbidity
Nasworthy#1	November	8.5	0	0.1	0.1	4	0	20	136	196	144	30
Concho #1	November	8.5	0	0.25	0.1	3	0.5	50	188	224	200	50
Concho #2	November	8	0.1	0.25	0	4	0	20	172	304	288	50
Concho #3	November	8.5	0	0.25	0.2	4	0	80	176	316	296	70
Concho #4	November	7.5	0.6	0.5	0.4	3	0	80	176	360	300	180
Concho #5	November	7.5	0.6	0.25	0	4	0.5	50	212	390	254	60
Colorado	November	8	1	1	0	3	0.5	20	156	380	304	40
Nasworthy#1	January	8.5	0	0.5	0	3	0	80	144	200	140	40
Concho #1	January	8.5	0	0.25	0	3	0.5	50	160	224	194	50
Concho #2	January	8.5	0.3	0.25	0	4	0.5	20	180	320	288	30
Concho #3	January	7.5	0.6	1	0	4	0	50	176	300	320	40
Concho #4	January	8	1	0.25	0	3	0	50	174	300	320	70
Concho #5	January	8.5	0.6	0.25	0	3	0	50	236	360	390	50
Colorado	January	7.5	1	1	0	3	0.5	20	136	386	216	50
Nasworthy#1	February	8.5	0.4	0.25	0	3	0	80	176	184	160	40
Concho #1	February	8.5	0	0.25	0	3	0	50	164	236	196	40
Concho #2	February	8.5	0.4	0.25	0	3	0	20	160	396	420	20
Concho #3	February	8	0.8	0.5	0	4	0	50	146	276	256	40
Concho #4	February	7.5	0.6	0.25	0	4	0	50	160	340	308	50
Concho #5	February	8	0.3	0.5	0	3	0.5	80	240	444	424	70
Colorado	February	7.5	1	0.5	0	3	0	20	116	520	420	40

Figure 3. Ordination plot showing the grouping of sites.



Results:

Detectable amounts of iron, sulfide, copper, cyanide, and phosphate were not found in any sample. An ordination plot of the data indicated a grouping pattern for the individual sites based on similarity and differences of their water quality parameters. Using Permutational MANOVA, water quality parameters were found to vary based on site ($P<0.001$). Statistical differences were not detected between given months ($P=0.889$). Post-hoc tests were unable to further confirm the grouping patterns indicated by the ordination plot.

Conclusion:

- Significant variation persists throughout the watershed system.
- Heavy metal contamination was not found.
- No water quality parameters were found to be cause for concern.

References

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